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THE UNIDO DATA BASE: PRIMARY SOURCES AND DATA BASE DESIGN*

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Summary

The following note provides an overview of the data base for industrial statistics which was developed and is maintained by the Statistics and Survey Unit, Division for Industrial Studies, UNIDO. Section A describes the orientation and approaches adopted by the Unit in carrying out this project. Two important aspects should be noted. First, UNIDO is primarily a user (rather than a producer) of industrial statistics and the construction and operation of the data base reflect this orientation. Second, the data base is primarily intended to meet the statistical needs of researchers engaged in international, or cross-country, studies rather than country-specific investigations. Accordingly, UNIDO statisticians give priority to the development of a set of international statistics which meets acceptable standards of consistency and comparability in terms of the statistical definitions and concepts used in compiling the country data.

With regard to the contents of the data base, information for 144 countries is included. The time series for each country is an annual one spanning the period 1963 to latest year (generally 1981). Data have been collected for five fields: value added, gross output, employment, wages and salaries and production indices. For each country, year and field, this information has been compiled for up to 28 industries in the manufacturing sector.[1/] The coverage for 60 countries is regarded as complete, meaning that statistics are generally available for all years, for each of the five data fields and for the 28 industries within manufacturing.

Section B describes the characteristics of the primary data received by UNIDO. The discussion highlights those aspects which are of

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1/ Data for some countries are partial and complete information is not available for every country and year. For further details, see section A.

major concern to users conducting cross-country studies. These include different national practices with regard to the definition of the manufacturing sector, the definition of the industries included in the sector, variations in concepts of valuation and measurement and the extent of non-reporting and non-response. Section C summarizes the approaches of UNIDO statisticians in dealing with each of these problems. It also describes the priorities assigned to the various sources of supplementary data (e.g. UNIDO field work, national and international sources) that may be relevant in dealing with the problems mentioned above.

The structure of the UNIDO data base is outlined in Section D. After receipt of the data by UNIDO, the information passes through several stages, all contained within the data base. At each stage, the data is evaluated and analyzed in relation to specific sources of supplementary information - namely national industrial censuses and surveys, UNIDO field work, input-output tables (stage II) and data compiled by a number of other international and regional organizations (stage III). Similarly, the methods of adjustment and estimation carried out in later stages (e.g. IV) are dependent on the results achieved in preceding stages. Finally, annex A provides a bibliography of national publications which, to date, have been utilized to supplement, extend or otherwise adjust the original statistics in order to develop a consistent and comparable set of international statistics on industry. Annex B gives a brief description of the 28 industries included in the manufacturing sector.

Copies of the UNIDO data base may be purchased by users outside the United Nations system. The charge for these data, which is provided in machine-readable form, is $500. Further details may be obtained from the Statistics and Survey Unit, Division for Industrial Studies, UNIDO, P.O. Box 300, A-1400 Vienna, Austria.

A. Orientation and Priorities

The UNIDO data base was established in 1977. At that time, the single supplier was the United Nations Statistical Office (UNSO). The data received by UNIDO were the equivalent to that published annually by the United Nations in the Yearbook of Industrial Statistics, volume I. During this initial phase, UNIDO statisticians gave priority to extending the coverage and detail of the published data. Gradually, additional suppliers of industrial data - including national sources as well as data compiled by the World Bank, OECD, United Nations regional commissions and EUROSTAT - were incorporated in the data base.

The subsequent experience gained in servicing users within UNIDO showed that most requests concerned only a few of the various types of data (or fields) collected by UNSO and appearing in the Yearbook of Industrial Statistics. These included: value added, gross output, wages and salaries (all expressed at current prices in national currency units), employment and production indexes. Accordingly, further statistical work in UNIDO focused on these five fields, all of which were entered in an on-line system.

The experience accumulated during the development phase also indicated the need to set some priorities that reflected user needs. UNIDO research is predominantly concerned with international (or cross-country) types of analyses; a smaller number of its studies are country-specific. A major problem in servicing the former type of studies is that the data reported to UNSO by national statistical offices vary widely in terms of coverage, concepts and definitions (discussed below).

In judging departures from international standards, UNSO follows the International Recommendations for Industrial Statistics and the concepts and definitions developed in connection with the International Standard Industrial

Classification (ISIC).[1/] The approach, as stated by UNSO, is as follows: "Deviations from these standards, where known, are mentioned in the introductory note to each country chapter or in the footnotes to each table."[2/] In other words, UNSO indicates discrepancies but does not adjust or correct them.

Owing to the condition of the data, a large portion of UNIDO's research effort was frequently devoted to preparatory statistical work.[3/] Extensive discussions between UNIDO and researchers in private institutions and universities led to the conclusion that they, too, faced similar problems. Thus, a major responsibility of UNIDO statisticians has been - and continues to be - the development of a data base which meets acceptable international standards for comparability and consistency.

Finally, with regard to the contents of the data base,[4/] data for 144 countries are included. The maximum time series for each country is from 1963 to the latest year (in general, 1981). Statistics on each of the five data fields are compiled according to the ISIC and are reported at the 3-digit level of that classification. Thus, the maximum number of observations would be 383,000 assuming full reporting for each country/year/field and for each of

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1/ For a description of these concepts, see International Recommendations for Industrial Statistics (United Nations publication: sales no. E.83.XVII.8) and International Standard Industrial Classification of All Economic Activities (United Nations publication: sales no. E.68.XVII.8)

2/ Yearbook of Industrial Statistics, vol. I, 1980 edition (United Nations publication: sales no. E.82.XVII.11), p.ix.

3/ Such operations entailed data screening, estimations, adjustments, etc. designed to ensure that the international statistics being used were roughly comparable and consistent in terms of definitions, concepts and scope of measurement.

4/ The contents of the UNIDO data base have been documented in detail. See, UNIDO, An Inventory of Industrial Statistics in the UNIDO Data Base, (UNIDO/IS.385, May 1983). Although that inventory does not represent the most recent status of the data, it provides a clear picture of the scope and coverage.

the 28 industries in the manufacturing sector.[1/] In reality, a total of 213,000 observations are currently contained in the data base.

B. Major Weaknesses of the Primary Data

For purposes of cross-country studies, the major problems encountered by UNIDO in using the data in their original form were the following:

(i) National differences in coverage by size of establishment. Most reporting countries exclude some portion of small-scale industry from the data provided to UNSO.[2/] Moreover, the definitions employed vary widely. For instance, one country may exclude information on establishments with less than 5 employees while another may ignore data for establishments with less than 50 employees. The problem has a second dimension: a national office may alter the scope of its collection exercise, as defined by size of establishment, in different years. In years when an industrial census is carried out, small scale establishments may be included but will be ignored in non-census years when a survey, using a reduced sample, is employed.

(ii) Departures from the ISIC classification. National classifications may not conform to the present version of the ISIC. Although the national office generally makes efforts to convert the data to the ISIC prior to submitting it to UNSO, discrepancies may remain. This often results in the reporting of an aggregate, i.e. a combination, for two or more industries, where an 'industry' is defined to be

1/ This maximum is calculated as follows: 144 (countries) x 19 (years) x 5 (data fields) x 28 (industries) = 383,040.

2/ This discrepancy often results from the fact that small-scale industry is outside the purview of the Ministry of Industry. Moreover, the legal framework governing the collection of data may arbitrarily exclude establishments below a given size - defined in terms of their work force or according to level of investment.

equivalent to the 3-digit level of the ISIC.[1/] A total of 28 industries are included in the manufacturing sector (ISIC 3) and the types of combinations varies both among countries and over time. An indication of the magnitude of this problem is suggested by the fact that in the primary data received by UNIDO the number of combinations exceeded 20 per cent of all observations.[2/]

(iii) National differences in definitions and concepts. In the original data at least two major differences in national statistical practices pose problems to the user. First, valuation may be at factor costs or producers' prices, depending on the treatment of indirect taxes and subsidies. Second, employment data may refer to the number of persons engaged or the number of employees.[3/] Either type of inconsistency will be significant for cross-country studies of specific industries. For example, the treatment of indirect taxes and subsidies will be particularly important in the case of industries such as beverages, tobacco, refining or steel. Inconsistencies in the definition of employment (as well as derived indicators relating to productivity) are especially apparent in employment-related studies of textiles, clothing and other industries where small-scale establishments and cottage industries are important.

1/ For example, data for textiles (ISIC 321) and clothing (ISIC 322) are sometimes combined and reported as one 'industry'. For a description of the ISIC classification, see annex B.

2/ Some combinations involve more than two industries. If all these combined observations were reported as single ISICs or unique observations, the total would exceed 35,000 observations.

3/ Persons engaged are defined as the total number who worked in the establishment during the reference year. The number of employees excludes working proprietors, active business partners and unpaid family workers - all of which are included in the number of persons engaged.

(iv) Non-reporting, either for individual branches or for the entire sector. Countries often base their replies to the UN questionnaire on the results of an annual survey. In a few cases, these surveys concern only selected manufacturing industries. For instance, in the case of Mexico, data for employment and wages and salaries cover only 58 out of 225 industrial groups in the national classification.[1/] Similarly, the annual industrial survey in Indonesia does not include petroleum manufacturing activities (ISIC 353 and 354).[2/] Finally, a few countries do not submit data to UNSO on a regular (i.e. annual) basis.

(v) The failure of national offices to adjust for non-response. The need to adjust for non-response is a problem encountered in any statistical survey or census. Although the majority of countries carry out such adjustments, this is not always the case. The failure to take account of non-response may be due to a lack of sufficient information, insufficient staff to carry out this task or any number of other explanations. The extent to which this factor will distort the census or survey results varies depending upon the industry in question and the type of data (output, employment, wages, etc.) being examined.

1/ See Yearbook of Industrial Statistics....., p. 357.

2/ Ibid., p. 241.

C. UNIDO Treatment of Major Weaknesses in the Data

Of the problem areas listed above, (iv) and (v) are, perhaps, the most difficult to redress. In contrast, problems (ii) and (iii) are sometimes solvable, provided that sufficient supplementary data (from both national and international sources) are available and that users are prepared to accept a reasonably modest set of assumptions employed to carry out adjustments. Finally, problem (i) - the need to account for national differences in coverage - may be addressed in at least a limited number of cases. The following discussion does not focus on the actual methods[1/] employed to deal with each of these problems but, rather, on the approaches and sources of information considered.

(i) National differences in coverage by size of establishment. The most significant inconsistencies in the data presumably arise when countries employ a 'cut-off point' that omits those establishments with less than 20, 30 or even 50 employees. The demarcation point may also vary depending upon the type of data being collected.[2/] In addressing this problem, UNIDO chose, as a desired standard, coverage of all manufacturing

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1/ For a discussion of the methods used by UNIDO in the adjustment and development of data on production indices, see Industrial Statistics for Research Purposes, Methodologies and a Data Inventory of Production Indexes (UNIDO/IS.309, 1982). A complete description of UNIDO methods employed in connection with the general industrial statistics (i.e. value added, gross output, employment and wages and salaries) in the data base will be published in 1984.

2/ For instance, Mexican data for gross output and value added refers to all establishments although the statistics on employment and wages and salaries concern only a limited portion of the manufacturing sector. See Yearbook of Industrial Statistics....., p. 357.

establishments with five or more employees.[1/] Information on small scale industry (e.g. establishments having 5 to 10 employees, 5 to 20 employees or 5 to 50 employees) can sometimes be obtained from national sources - mainly industrial censuses and special surveys of small-scale industry. These publications provide details on value added, wages, employment, etc. broken down both by size of establishment and by industry. A drawback is that such information is available only for selected years. However, relative to the contribution of medium and large scale establishments, the importance of small-scale enterprises (whether measured in terms of total manufacturing, employment, output or wages) is not likely to shift drastically in a period of five years, for instance. Thus, where such information can be obtained, it provides a possible means for adjustment which is based on data for the country in question.

There will always be countries where no such data are available and adjustments can not be carried out. For all countries, UNIDO has compiled an annual inventory showing variations in the definition of the cutoff point for each type of data, along with information concerning the adjustments made by statisticians.

(ii) Departures from the ISIC Classification. The most frequent violation of the ISIC classification concerns the practice of combined reporting, i.e. data for two or more industries are reported as an aggregate. Such

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1/ In carrying out this work, no attempt was made to adjust the data for countries where coverage of the manufacturing sector extends to all establishments or to those with less than five employees.

combinations may occur in any of the five data fields with which UNIDO is concerned. Furthermore, the combinations may be different depending on the data in question and they may change from year to year. Clearly, widespread violations of the ISIC classification can pose serious problems for users attempting to study one or more specific industries. The problem becomes more acute when researchers have need for more than one field of data (e.g. an analysis of productivity which would require the matching of data on output and employment) since the combination of industries is not necessarily the same for different fields.

UNIDO's collection of national censuses, surveys and input-output tables (described above) is an obvious source of additional information to rectify some of these classificational discrepancies. Often these publications provide statistics which are far more detailed then those published in the Yearbook of Industrial Statistics. Other sources (both published and unpublished) include the World Bank, OECD, EUROSTAT, ILO, FAO and data compiled by United Nations regional commissions. Industry-specific data such as that collected by the International Iron and Steel Institute is also helpful. All this information is utilized by UNIDO statisticians in their efforts to reconcile the primary data with the ISIC.

(iii) National differences in concepts and definitions. Supplementary information which may be used to convert from producers' prices to factor costs or from number of persons engaged to number of employees is not readily available. The concepts used when carrying out an industrial census or survey are generally the same as those employed when reporting to UNSO. Consequently, UNIDO's work to date has gone no further than to document - in the data base - the various concepts

and definitions employed by each country throughout the available time period. Some possibilities to account for differences in conceptual practices may be available, however. For instance, a limited number of countries simultaneously report according to two definitions (e.g. persons engaged and employees). If information for a number of countries can be compiled, a comparison of the variation between corresponding sets of data may provide the basis for ad hoc conversion factors to be used. Information on indirect taxes and subsidies, available from national accounts data as well as national censuses may also provide a means of accounting for differences in conceptual practices.

(iv) Non-reporting. In some instances, countries report no data whatsoever for one or more years. UNIDO statisticians conduct a search for data from international sources and the field reports of experts to include observations for missing years. If the search is not successful, statisticians may make estimates provided that no more than two years are missing and the time series is otherwise complete. Where non-reporting concerns only specific industries or fields of data, a similar search of appropriate sources is carried out. If available data are known to cover only part of an industry and no supplementary information can be located, the observations are deleted from the data base.

(v) Non-response. Very little information is available to international statisticians to deal with this problem. UNSO provides some insights into the scope of the problem by indicating, in the country notes of the Yearbook of Industrial Statistics, the extent to which countries have

adjusted for non-response. Future work will include a file developed by UNIDO which documents those cases where response ratios are known to be low.

D. Structure of the UNIDO Data Base

In line with the research priorities outlined earlier in this paper and based on the experience accumulated in the previous seven years of operation, UNIDO redesigned its data base in 1984. At present, the new design incorporates four distinct and separately identifiable stages.[1/] All data pass through each of these stages and, at each stage, are subject to various forms of examination and/or adjustment. The purpose of the new structure is twofold. First, the layout facilitates the organization of the work of UNIDO statisticians - both with regard to statistical methods and data sources. A 'stages approach' serves to impose a hierarchical set of priorities on the work of statisticians with regard to the sources which they utilize and, indirectly, the statistical methods they employ. As explained below, information from national sources (published and unpublished) receives a higher priority than similar data supplied by international sources. Accordingly, different sources for data modification are associated with each stage in the data base. Second, the stages approach lends itself to more extensive use of the computer for data screening, analysis, editing, etc. This is a natural consequence of the fact that development of the data base is now broken down into a series of specially defined tasks which are carried out

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1/ Additional stages may be added at a later date. The incorporation of later stages is contingent on the successful development of standardized methods of estimation, using both time series and cross section approaches, to deal with outstanding types of inconsistencies which remain in the data base after completion of stage IV.

in a pre-determined sequence. The following discussion summarizes the priorities imposed on information sources and data analysis in terms of the stages in the UNIDO data base.

Stage I - Responses to national questionnaires compiled by UNSO. At this stage the data is a duplicate, in machine-readable form, of that provided to UNIDO by UNSO. Information has been compiled from replies to questionnaires sent by UNSO to national offices. Prior to its receipt by UNIDO, the data has already been subject to a certain amount of screening by UNSO to determine consistency and accuracy. Upon completion of this exercise, UNSO publishes the results annually in the Yearbook of Industrial Statistics - Volume I, General Industrial Statistics. Consequently, the condition of the data already reflects the results of considerable work - carried out by UNSO - to identify and to document any known departures from the International Recommendations for Industrial Statistics.

Stage II - The incorporation of national data. Work begins by drawing upon UNIDO's collection of national statistical publications. These consist of industrial censuses, surveys and a smaller number of input-output tables. Statisticians compare the information in the national publication with that communicated to UNSO for the corresponding year(s). In doing so, they rely heavily on the earlier work of UNSO to identify and document departures from the ISIC. In many instances the two sets of data are identical. However, an international publication such as the Yearbook of Industrial Statistics must, inevitably, exclude a certain amount of data - as well as information about the data (META data). Such information is extremely useful to statisticians

whose mandate is to take account of - rather than to document - significant departures from the international classification. Examples would include the following:

(a) The reconciliation of discrepancies previously noted by UNSO: National publications frequently provide useful details regarding output and employment by size of establishment. They may contain a more extensive disaggregation of activities than the 3-digit level of the ISIC. Where the national classification differs from the ISIC, additional description is usually available in national publications. This and other information is of great use in cleaning or otherwise adjusting the data to meet the desired definitions and concepts.

(b) The inclusion of final, rather than preliminary results: The national statistics supplied to UNSO are sometimes based on provisional data, e.g. the preliminary results of an annual survey or census. Subsequent publication of the final results by the national office may alter the original figures or may provide more statistical detail and related information than was previously available to UNSO. Here, the work of UNIDO statisticians consists mainly of updates or revisions but may also include the elimination of various discrepancies noted in connection with the ISIC.

(c) The incorporation of data from additional national sources: A number of producers of industrial data may exist in any country. For instance, one institute may compile detailed production indices for the manufacturing sector while another is concerned with data on

employment or salaries. In addition to national statistical offices, central banks, national planning institutes, ministries of labour, etc. may all compile official statistics and issue them at different times. UNSO can not always take all sources into account in their annual compilation of international data. However, improvements in the UNIDO data base are not tied to an annual publication such as the Yearbook of Industrial Statistics. Statistical work in UNIDO may consist not only of updates but revisions involving any year between 1963 to present, and this luxury permits a painstaking and extensive search of all potential national sources.

(d) The inclusion of statistics compiled through field work: Beginning in 1983, UNIDO undertook additional efforts to upgrade the quality of industrial statistics. These projects concern specific countries where data were not previously available or where the UNSO data available departed significantly from the International Recommendations for Industrial Statistics and sufficient information was not available to take account of these discrepancies. Field work is carried out by UNIDO statisticians and/or experts who are usually national statisticians already working in the country. Two field projects were carried out in 1983, two more are underway in 1984 and others are planned in future years. In addition to these projects, UNIDO is currently implementing a regional statistical project - funded by the Japanese Ministry of International Trade and Industry (MITI) - which involves the collection of detailed industrial data for 12 Asian countries and field work in five of these countries. All such projects are designed to supplement and extend the existing country statistics. Thus, the results are of immediate relevance for the data base.

Stage III - The inclusion of data from additional international sources. As indicated above, when producing the Yearbook of Industrial Statistics, vol.1, UNSO statisticians are concerned solely with two aspects: (i) the compilation of country responses to the industrial questionnaire and (ii) documentation of departures from the International Recommendations for Industrial Statistics and the ISIC. In extending the work of UNSO, UNIDO gives highest priority to the UNSO data (stage I), as supplemented by national data (stage II). However, other international institutions also compile industrial data concerning a variety of subjects and, sometimes, in considerable detail and these sources are sometimes useful in further development of the UNIDO data base.

Initially, international data sources are carefully screened by UNIDO statisticians to determine their quality, coverage, scope and definitions. Where UNIDO standards are met, the information is considered by statisticians in their work on the data base. The uses for such data may include adjustments in the available data emerging from stage II to ensure compatibility in terms of coverage, to account for departures from the ISIC, to include previously missing observations, etc.[1/] In addition, unpublished data, mainly in machine-readable form, is obtained from various institutions - the World Bank, EUROSTAT, Economic Commission for Africa, Economic Commission for Europe, ILO and FAO - and is incorporated in stage III when this is practical.

1/ Published sources which have been utilized in connection with the work at stage III include Eurostat, ACP, Statistical Yearbook; ECLA, Statistical Yearbook for Latin America; ECWA, Statistical Abstract of the Region of the Economic Commission for Western Asia; ESCAP, Statistical Yearbook for Asia and the Pacific; ILO, Yearbook of Labour Statistics; UNESCO, Statistical Yearbook; United Nations, Yearbook of National Accounts Statistics, Statistical Yearbook and The 1973 World Programme of Industrial Statistics; United Nations Office for Development Research and Policy Analysis, Handbook of World Development Statistics.

Stage IV - UNIDO estimates. Upon completion of stage III the various sources of industrial statistics, in descending order of priority, are UNSO, national publications and international sources. At this point considerable progress has been made in rectifying some of the more obvious problems which detract from the use of industrial data in international studies. However, all adjustments carried out in stages II and III have been 'cell-specific', that is, the work of statisticians has been confined to data cleaning operations for the given country, data field, industry and year for which exogenous information was available.

The most obvious way of extending the work from stages II and III - as well as the approach which requires only modest assumptions about growth and structural change - is to make use of these results to clean previously untouched data pertaining to the same industry and field in other years. Thus, information gathered in stages II and III is utilized to make further adjustments for years other than those considered in earlier stages. To date, the work in stage IV focuses on one specific problem - the practice of combined reporting (i.e. reporting an aggregate for two or more industries defined at a 3-digit level of the ISIC). After extracting further information from national and international sources, many of these combinations have been eliminated - for specific years and industries - from the original country data. Where a sufficient number of years have been cleaned, the results are then applied to remaining years in the time series 1963-81.[1/]

1/ The methods of estimation are straight-forward but vary depending on the number of observations in this time period which have previously been adjusted to the ISIC 3-digit level of specification. An extensive description of these methods, and the results, will be published in 1984.

In conclusion, upon completion of stage IV, many of the outstanding discrepancies in the original data have been eliminated. The reader should be cautioned, however, that the problems described in section B of this paper have, by no means, been completely eliminated. UNIDO's efforts to improve the quality of industrial data - in collaboration with UNSO - will continue. The data base will be updated annually but work to extend the detail and to standardize concepts and definitions will be a permanent feature of the statistical programme.

ANNEX A

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Used in Conjunction with the Unido Data Base

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ANNEX B

Classification of Industries According to the ISIC

Industry	ISIC
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Pottery, china and earthenware	361
Glass	362
Other non-metallic mineral products	369
Iron and steel	371
Non-ferrous metals	372
Metal products, excluding machinery	381
Non-electrical machinery	382
Electrical machinery	383
Transport equipment	384
Professional and scientific equipment, photographic and optical goods	385
Other manufacturing	390

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INDUSTRIAL DEVELOPMENT ORGANIZATION

Expert Group Meeting on
Technology Exports from Developing Countries
Vienna, Austria, 19-21 December 1983

Report*

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Introduction

1. The Expert Group Meeting on Technology Exports from Developing countries was held in Vienna, Austria, from 19-21 December 1983. The purpose of the meeting was:

- to review the experience of some leading developing countries in the field of technology exports and to identify constraints and potentials;
- to identify policy actions to be taken by the governments of developing countries to promote technology exports;
- to discuss and make recommendations concerning informational mechanism for promoting and facilitating international exchange of commercially available technologies developed or adapted in developing countries; and
- to identify the lines of international action and particularly further action by UNIDO in this field.

Conclusions and recommendations

2. The meeting reviewed carefully the UNIDO country studies on export of technology from developing countries and considered these studies a valuable contribution towards a better understanding of the nature, potential and constraints of technology exports from developing countries. It recommended that UNIDO would take into consideration in any country or regional study on technology policy, the element of technology exports as a possible contributing factor in obtaining the development objectives.

3. Since one of the principal constraints for the effective flow of technologies from developing countries is the lack of technological information and its effective diffusion, and recognizing that a number of national, regional and global systems of information were in existance for a variety of purposes, the meeting recommended:

a. an international information mechanism be introduced which would facilitate the exchange of basic data on technologies commercially available in developing countries;

b. such a mechanism should be based to the largest possible extent on the existing national, regional and international information systems;

c. country missions should be undertaken to review and examine their potentials as effective contributers to the international technological information mechanism;

d. a meeting of representatives of national focal points should be convened to evolve the concept and operational framework, and initiate the mechanism itself.

4. Since a framework for national and international action will be based on the proper understanding of the nature, potentials and constraints of the phenomenon of technology exports from developing countries and recognizing that most empirical studies have focussed on the experience of the exporting country, the meeting recommended that further studies be undertaken to increase understanding, particularly in the following areas:

a. bias against technologies from developing countries;
b. the role of transnational corporations;
c. role of national industrial structure and policy environment, in particular those related to technology transfer regulation and technological development;
d. potential benefits for the technology recipient.

5. Recognizing that there is a need for a more effective marketing of technologies from developing countries, the meeting recommended the study of the feasibility for establishing technology trading companies either at a national or international level, as a network of such institutions.

6. Recognizing the importance of the diffusion of technologies from developing countries by the reduction of bias against the emerging suppliers, the meeting recommended that international agreement should be reached on the appropriate joint promotional measures which may include a combination of preferential terms, insurance and financial guarantees.

I. Organization of the meeting

7. The expert group meeting was attended by five participants and three observers from international organizations.

Opening of the meeting

8. The meeting was opened by the Director of the Division for Industrial Studies of UNIDO who stated that the Third General Conference of UNIDO in

its New Delhi Declaration and Plan of Action on the industrialization of developing countries and international co-operation for their industrial development, stressed the necessity for establishing and fostering national capabilities for identifying and encouraging endogenous industrial technologies and to give high priority to programmes of co-operation between developing countries as well as to foster their technological co-operation.

9. At the same time, total technology exports of developing countries, in terms of royalties, know-how fees, engineering and consultancy payments, amounted to approximately $100 to $150 million in 1978, as against total imports by these countries of approximately $2 to $3 billion. The amount of technology payments by developing countries will increase, according to UNIDO's forecast, to $6 billion by the year 1985. Most of these payments represent payment outflows by the third world for imported technology and know-how from industrialized countries.

10. Apart from massive technology payments for imported technology, there is another problem which makes it necessary for more attention to be paid to technological co-operation among developing countries and in particular, to the promotion of technology exports from these countries, and this is the problem of the relevance of the technology to be or being transferred. In this respect, the flow of technologies originating in, or adapted by, developing countries to other developing countries is of prime importance.

Election of officers

11. The following officers were elected:

Chairman: Mr. C.B. Jain (India)

Rapporteur: Mr. J. Monkiewicz (Poland)

Adoption of the agenda

12. The following agenda was adopted:

1. Opening of the meeting
2. Election of chairman
3. Adoption of the agenda
4. Review of the experience in the field of technology exports of some developing countries, their potentials and constraints
5. Governmental policy actions to promote technology export
6. International technological information mechanism and actions to promote and facilitate exchange of commercially available technologies originated in developing countries
7. Actions to be taken by UNIDO
8. Adoption of the report

II. Summary of discussions

Agenda item (4) - Technology exports from developing countries, its nature, potentials and constraints

Nature

13. Technology exports from developing countries are the results of their increasing maturation in the process of development. Empirical studies have shown that in the majority of cases these are based on adapted technologies exported in the form of technological services. There is a certain amount of comparative advantage for developing countries in some markets where their technology may be more appropriate. Some of these markets are characterized by the absence of strong competition from the traditional source of supply. However, in some sectors they are in more direct competition with the rest of the world.

14. Interrelationships between the policies on importation and assimilation of technology and a country's technology export strategy should be clearly understood. Such an understanding would increase technology export capability and would allow measures to be taken at an early stage of the process.

15. Since thechnology exports from developing countries are not independent from the national industrial structure and policy environment, including industrial trade and technological development policy, it would be useful to have a clearer understanding of such interrelationships.

16. Since most studies have concentrated on a limited number of exporting countries, there is a lack of proper understanding of the experience with technologies imported from other developing countries.

Potential

17. Rich experience of adaptation and application of technologies exists in developing countries, in addition to some experience with self-generated technologies, although it is dispersed and not easily accessible. Experience of this nature should be shared, and new technologies made available to other countries, thus reducing time and expenditure involved in creating what has already been done.

18. The potential for technology exports is directly related to the benefits accruing to both the exporting and importing countries and enterprises. Such benefits may include:

(1) More appropriate technology in terms of decreased costs, social values or the best use of local raw materials;

(2) Broadening the sources of technology which may improve the bargaining position of the buyer:

(3) Positive feedback for the sellers which may further their technological development;

(4) Increased self-confidence among developing countries with respect to their own technological capabilities.

19. A better assessment of the potential benefits required a better understanding of the nature of the different modes of transaction since their costs and benefits to the sellers and buyers in the long and short run are different.

Constraints

20. One of the principal constraints is the lack of appropriate information relating to both the potential importer and exporter of technology. The buyer will not have information about alternatives and the seller may not be aware of the potential demand of his technology outside his country. A related aspect is how to obtain an effective diffusion of information as merely the availability of information is insufficient.

21. The second constraint is the lack of adequate assessment capability on the importer's side in order to be able to adequately judge the potential benefits of technology.

22. The financial system is a powerful element influencing the source of technology and related inputs. The financial weakness of developing countries puts them at a disadvantage vis-à-vis the developed world in promoting the exports of their own technologies and inputs. This relates both to technology suppliers and buyers.

23. A related constraint is the bias that frequently exists against technologies where there is little experience available in order to judge their effectiveness in practice. This bias is rational in so far as it derives from an aversion to risk, but it nonetheless hinders appropriate diffusion and may be counteracted by insurance or other mechanisms.

24. Exports of technology require certain specific skills and knowledge from the exporting organizations and countries. Lack of proper experience and trained people may be an important element hampering export activity.

25. The phenomenon of market dominance by, in some instance, traditional suppliers of technology, tends to inhibit the development of indigenous technology to its full measure and is the consequential constraint on technology exports. It also restricts broadening the choice of technology import from alternative supply sources from developing countries.

Agenda item (5) - Policy actions to promote technology exports

National

26. There is an obvious need for promoting technology export activity both at the national policy makers' level as well as the international level.

27. The export of technology should be seen as one of the products of a local technological advance and a contributing factor which enables greater economics of scale, specialization and learning. Promotion of technology exports must therefore be seen in the context where the objective is the building up of an appropriate local technological development. A major practical problem is the attainment of a proper balance in the degree of protection which is provided at the national level. Such a balance however can only be achieved by iterative actions.

28. To procure a stronger foothold in the international technology market, developing country exporters have to receive much more assistance from their respective governments. The degree of promotion offered should be viewed from the point of view of the targets that can be achieved at the national level. This requires a proper understanding of the nature of the transactions involved. It may be advisable that technology export incentives be given at least as much attention and priority as incentives for commodity export transactions and technological activities related to the local market.

29. In the short run, as a greater understanding is acquired on the nature, potential, benefits and constraints an area for immediate action is the development of an effective information system which will facilitate technology flows among developing countries on the technologies available from developing countries.

30. In order to create a sound basis for government action in the aforementioned area, it may be necessary to begin with the establishment of reliable statistics of the technology export contracts concluded and subsequently a system for their monitoring integrated in the system for the promotion for the local technological capability.

31. Greater association with consulting and design engineering firms by local developers of technology could help in promoting technology exports through the transformation of available technologies into technologies already in use commercially.

32. In order to promote technology exports from developing countries, and based on the proper understanding and awareness of its potential, training programmes should be developed or existing ones ammended to reduce barriers and uncertainties of potential exporters and importers and thereby increase the managerial capability to handle such transactions.

33. In order to promote technology exports, appropriate measures should be taken at the national level in developing countries to provide local entrepreneurs and enterprises with the possibility to compete with traditional sources of technology in foreign markets through appropriate credit and tax policies.

34. National policy action to promote the export of technology must be linked to an integrated national technology policy, and as such, national technology transfer laws should be adapted for this purpose.

International action

35. Apart from the creation and better utilization of the existing information system, efforts such as solidarity meetings for LDC's, Investment Promotion Meetings and plant level co-operation programmes should be better utilized as a contributing factor to the bridging of the information gap.

36. Development of case studies to analyze successes and failures of intra-developing country technology transactions, in particular from the point of view of the acquiring party, would contribute to a better understanding of its nature.

37. To increase the appropriate diffusion of technologies from developing countries by the reduction of bias against the emerging suppliers, international agreement should be reached on the appropriate joint promotional measures which may include a combination of preferential terms, insurance and financial guarantees.

38. To reduce the financial constraints, the existing financial infrastructure at the international level should be adapted to enhance the technology transfer flows among developing countries.

39. In order to increase the promotional and organizational capability of developing countries to export technology, existing experience should be shared and resources drawn together to accelerate the further development of such efforts. This sharing can take the form of joint marketing efforts (e.g. technology marketing agency), joint bidding efforts in predetermined priority sectors for technological development and joint trainging efforts, including the preparation of guidelines.

Agenda item (6) - Technological information exchange mechanism

40. The meeting discussed the issue of technological information exchange as an important supportive measure for promoting and accelerating flow of technologies among developing countries as well as to industrialized countries. The nature of the information and some end-users of the information were broadly identified. Possible institutions in developing countries who could act as national focal points for gathering technology and related information in their countries and constitute a part of UNIDO system, were discussed. Such focal points are also expected to disseminate information on technology and associated services in their own country to potential users and enterprises.

41. Different types and degrees of information would be needed by various groups of users. Among the groups of users identified by the meeting are the following:

i) Industrial associations of enterprises and entrepreneurs,
ii) Manufacturing sectors,
iii) Chambers of commerce and industries of entrepreneurs (associations),
iv) Professional engineers' and managers' associations,
v) Research and development institutions,
vi) Government departments concerned with industrial and technological development and export of technologies, engineering services, capital goods and turn-key projects,
vii) Development banks and industrial financial institutions,
viii) Academia,
ix) Media.

42. It was recognized that all elements of information cannot be available to the various groups at a given point of time due to resource constraints. In this context, the importance of providing technological information to industrial enterprises was stressed.

43. The Group recognized that a number of national, regional and global systems of information were in existence for a variety of purposes. It was suggested that the proposed information system of UNIDO for promoting and facilitating technological flows should take into account such existing systems and their orientation. Such a system should also be looked upon as an additional and powerful source of technological information for INTIB services.

44. Arising out of the discussion, concensus was reached that the information system on technology flows among and from developing countries to developed ones, is of critical importance to increasing technology exports from developing countries. In the light of this, the following recommendations emerged for future course of action.

At the country level:

- Nominate a national institution to serve as a focal point for UNIDO's technological information system. The national focal point may establish further linkage with other institutions within the country specialised in different technological spheres;
- Strengthen existing national information mechanisms for gathering and disseminating information on commercially available technologies for export as well as for the domestic market. Special attention will have to be paid to increasing such exports among developing countries.

At the UNIDO level:

- To identify national focal points in selected developing countries through consultations with these countries and examine their potential as effective contributors to the UNIDO information system;

- To establish working relationships with national focal points in order to facilitate an effective and efficient flow of technological information to and out of these countries, particularly among developing countries;
- To survey the existing regional and global information networks to identify the manner in which linkages can be established as far as technological information contacts are concerned;
- To organize a meeting of representatives of national focal points to evolve the concept and operational framework for UNIDO's technological information mechanism within the overall framework of INTIB.

Annex I

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Annex II

List of Documents

CRP. 1	Technology Exports from Developing Countries: issue paper
CRP. 2	International exchange of commercially available technologies, originated from developing countries - informational aspects, Note by the UNIDO Secretariat
CRP. 3	Technology Exports from Developing Countries, C.B. Jain
CRP. 4	An approach to evaluation of Yugoslav Technology Exports, Dusan Strujic
CRP. 5	Technology Exports from Korea, Y.H. Kim
CRP. 6	Intra-developing countries technology flows: Some aspects and issues, Kan D. Mariwalla
CRP. 7	Technology Exports from Developing Countries, Dimension, Significance, Implications and Issues. Summary Report of five country studies (preliminary version)
ID/208	Technologies from developing countries (I)
ID/246	Technologies from developing countries (II)
ID/289	Technology exports from developing countries (I) Argentina and Portugal
UNIDO/IS.353	Technology exports from developing countries, the case of Yugoslavia
UNIDO/IS.362	Technology exports from developing countries, the case of Egypt